Making Combos

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	2048 mebibytes

Evirir the dragon is playing a video game where it will chain skills to maximize its damage output.

There are N distinct *skills*, numbered $0, 1, \ldots, N-1$, that Evirir can perform. For each skill i, its *colour* is C_i and its *damage* is D_i. There are M *skill links*, which are pairs of skills (U_i, V_i) for $0 \le i \le M-1$.

A *combo* is a sequence of skills $s_0, s_1, \ldots, s_{l-1}$ of length $l \ge 1$ such that for $0 \le i < l-1$, (s_i, s_{i+1}) is one of the M skill links. It is guaranteed that in the input, skill links never form a cycle. That is, it is impossible to build a combo that contains the same skill twice.

The *total power* of that combo is calculated as follows. There is a *multiplier* B; initially $B = 1$. For $i = 0, 1, \ldots, l-1$, in order:

- If $i = 0$, do nothing.
- Otherwise:
  - If skills s_i and s_{i-1} have the same colour, multiply B by 2.
  - If skills s_i and s_{i-1} have different colours, set B to 1.
- Then, the *power* of skill s_i is $D_{s_i} \times B$.

The total power of the combo is the sum of the powers of all performed skills.

For example, suppose the combo has skills $(3, 7)$, $(2, 5)$, $(4, 7)$, $(1, 7)$, $(5, 7)$, $(6, 7)$, $(3, 6)$ in that order, where (x, y) denotes a skill with damage x and colour y. Here's a breakdown:

	s_0	s_1	s_2	s_3	s_4	s_5	s_6
Colour C_{s_i}	7	5	7	7	7	7	6
Damage D_{s_i}	3	2	4	1	5	6	3
Multiplier B	1	1	1	2	4	8	1
Power	$3 \times 1 = 3$	$2 \times 1 = 2$	$4 \times 1 = 4$	$1 \times 2 = 2$	$5 \times 4 = 20$	$6 \times 8 = 48$	$3 \times 1 = 3$

Then the total power of the combo is $3 + 2 + 4 + 2 + 20 + 48 + 3 = 82$.

Naturally, Evirir wants to perform a *combo* with the maximum total power. To achieve this, Evirir installed a hack that can change the colour of any skill to a fixed colour T. Evirir can only use the hack at most K times (i.e. it can change the colour of at most K skills).

What is the maximum total power Evirir can achieve? If the maximum total power is strictly greater than 10^9, output -1.

Input

The first line contains four space-separated integers, N, M, K, and T.

Then, N lines follow, where the i-th line contains two space-separated integers, D_i and C_i.

Then, M lines follow, where the i-th line contains two space-separated integers, U_i and V_i.

Output

Output an integer, the maximum total power possible. If it is strictly larger than 10^9, output -1 instead. If it is exactly 10^9, you should output 10^9.

Scoring

For all test cases, the input will satisfy the following constraints:

- $1 \le N \le 10^4$
- $0 \le M \le \min\left(10^5, \frac{N(N-1)}{2}\right)$
- $1 \le D_i \le 10^8$ for all $0 \le i \le N-1$
- $0 \le C_i \le N-1$ for all $0 \le i \le N-1$
- $0 \le T \le N$. **Note that T may be N**, an unused colour.
- $0 \le K \le N$
- $0 \le U_i, V_i \le N-1$ and $U_i \ne V_i$ for all $0 \le i \le M-1$
- The pairs (U_i, V_i) are pairwise distinct for all $0 \le i \le M-1$.
- It is guaranteed that *skill links* never form a cycle. That is, it is impossible to build a *combo* that contains the same skill twice.

Subtask	Points	Additional constraints
1	8	$M = N-1$, $(U_i, V_i) = (i, i+1)$ for all $0 \le i \le M-1$, $K = N$
2	9	$M = N-1$, $(U_i, V_i) = (i, i+1)$ for all $0 \le i \le M-1$, $K = 0$
3	31	$M = N-1$, $(U_i, V_i) = (i, i+1)$ for all $0 \le i \le M-1$, $N \le 50$
4	14	$N \le 50$
5	17	$M = N-1$, $(U_i, V_i) = (i, i+1)$ for all $0 \le i \le M-1$, $N \le 300$
6	17	$M = N-1$, $(U_i, V_i) = (i, i+1)$ for all $0 \le i \le M-1$
7	4	—

Examples

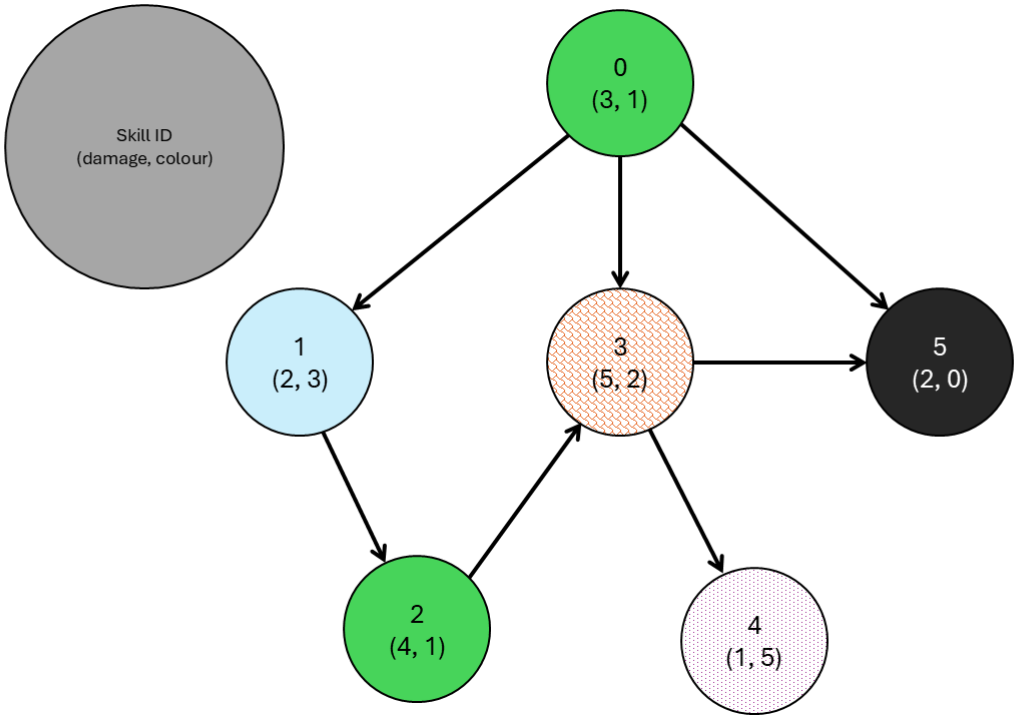
example input	example output
6 7 2 1 3 1 2 3 4 1 5 2 1 5 2 0 0 1 3 4 2 3 0 3 3 5 1 2 0 5	65
5 4 0 5 2 0 3 1 2 0 3 0 13 0 0 1 1 2 2 3 3 4	65
4 3 4 0 100000000 0 100000000 1 100000000 2 100000000 3 0 1 1 2 2 3	-1

Note

Example 1

This example is valid for subtask 4 and 7.

Here is a visualisation. An arrow from skill x to skill y means that there is a skill link (x, y), i.e. Evirir can do skill y immediately after skill x. The big circle on the top left explains what each number means.



Evirir can change the colour of at most $K = 2$ skills to colour $T = 1$. It can change the colour of skills 1 and 3 to colour 1, then perform skills $0 \to 1 \to 2 \to 3 \to 5$. The total power is $(1 \times 3) + (2 \times 2) + (4 \times 4) + (8 \times 5) + (1 \times 2) = 65$.

An example of a non-combo is the sequence of skills $0 \to 3 \to 4 \to 5$, because $(4, 5)$ is not one of the M skill links.

Example 2

This example is valid for subtasks 2, 3, 4, 5, 6, and 7.

There are $N = 5$ skills and $M = 4$ skill links. $K = 0$, so Evirir cannot change the colour of any skill. The optimal combo is to perform skills $0 \to 1 \to 2 \to 3 \to 4$. The total power is $(2 \times 1) + (3 \times 1) + (2 \times 1) + (3 \times 2) + (13 \times 4) = 65$.

Example 3

This example is valid for subtasks 1, 3, 4, 5, 6, and 7.

Since $K = 4$, Evirir can change the colours of skills 1, 2, and 3 to colour $T = 0$. The optimal combo is to perform skills $0 \to 1 \to 2 \to 3$. The total power is $(10^8 \times 1) + (10^8 \times 2) + (10^8 \times 4) + (10^8 \times 8) > 10^9$. Since the maximum possible power is strictly larger than 10^9, output -1.